Space Weather Technical Forecast

Issued on Tuesday, 05 March 2024 at 13:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-Class flares throughout. Slight chance of G1/Minor Storm conditions on 07 and 08 March.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Low with a peak C2.6 flare emanating from the vicinity of AR3592 and AR3598 close to the southwest limb. There are 11 classified sunspot regions, with AR3595 the largest region but which has simplified over recent days. AR3602 demonstrated some spot emergence to the north of the region. A further, as yet unnumbered region is rotating onto the eastern limb. The remaining regions are either weak or fading. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar wind parameters observed at L1 have averaged around 350-400km/s following a CME arrival on 03 March. Density has been below average. Total magnetic field strength started at moderate levels, around 10nT, but has weakened to around 5nT. The north-south component has varied weakly throughout between +5nT and -5nT. Phi angle has been negative (away from the Sun) throughout, Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was predominantly at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 05/0000UTC was 1.03e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Low with a chance of M-class flaring, mainly due to the region in the far western hemisphere.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 03 March may glance the Earth on 07 March, with low confidence. A coronal hole high speed stream is also forecast to connect with the Earth, either on 07 March, but more likely on 08 March, with estimated speeds of 400-500km/s. Geomagnetic activity is expected to be Quiet to Unsettled through 05 and 06 March. This may then reach Unsettled to Active levels through 07 and 08 March, with a slight chance of G1/Minor Storms from either the CME or coronal hole high speed stream connection.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to persist at background levels, but with a very slight chance of rising above the S1/Minor Radiation Storm threshold should any significant flares occur from the numerous sunspots that occupy the western disc. GOES16 high energy electron flux is expected to remain at mainly background levels, with the associated 24hr fluence remaining well below the Active threshold.

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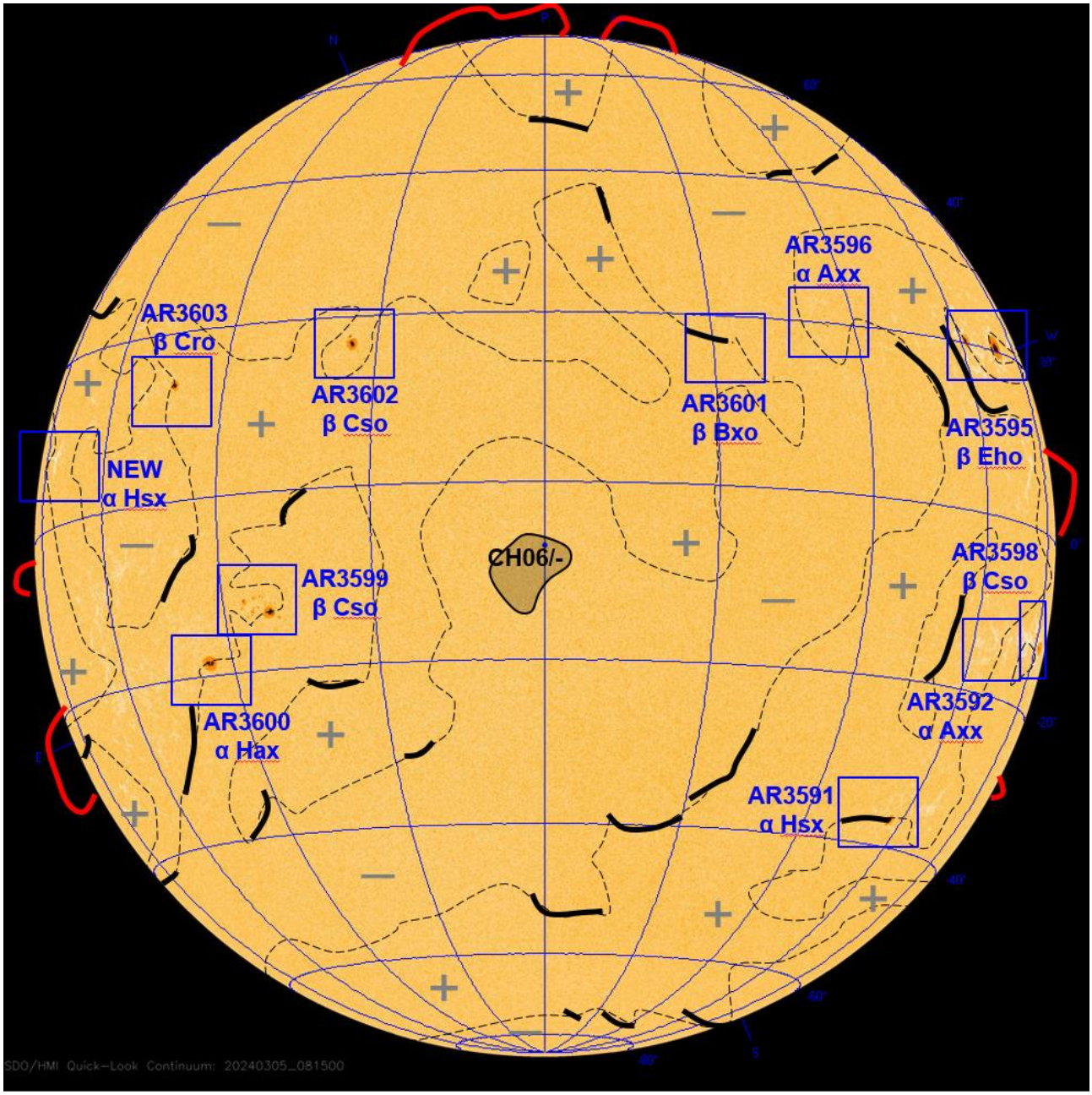
Figure 1. Solar Analysis Valid 05/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME left the southwest of the Sun on 03 March and may glance the Earth on AR3591, with impacts possible on 07 March, although this is low confidence. No other CMEs are forecast to affect the Earth.

Otherwise the Earth is in a slightly elevated solar wind environment following the arrival of a CME on 03 March. Winds are expected to decline to background through the next 48 hours. The CME from 07 March is then due to arrive on either 07 or 08 March with an estimated speed of around 500km/s, but low confidence in both speed and direction with a glancing blow possible. A negative polarity coronal hole currently in centre disc is forecast to possibly connect with Earth either during 07 or more likely into 08 March with possible speeds between 400-500km/s, although as this is a new feature, these speeds are an estimate. Geomagnetic activity from this feature could be favoured for a strong connection close to the March equinox.

Quiet to Unsettled geomagnetic activity is forecast on 05 and 06 March. Unsettled to Active activity is then possible through 07 and 08 March, with a slight chance of G1/Minor Storm conditions due to the CME, coronal hole high speed stream, or a combination of the two features.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
03/1730	Partial	Filament	Near AR3591 – SW quadrant	500 km/s	07/0600 UTC	Low confidence, glancing blow

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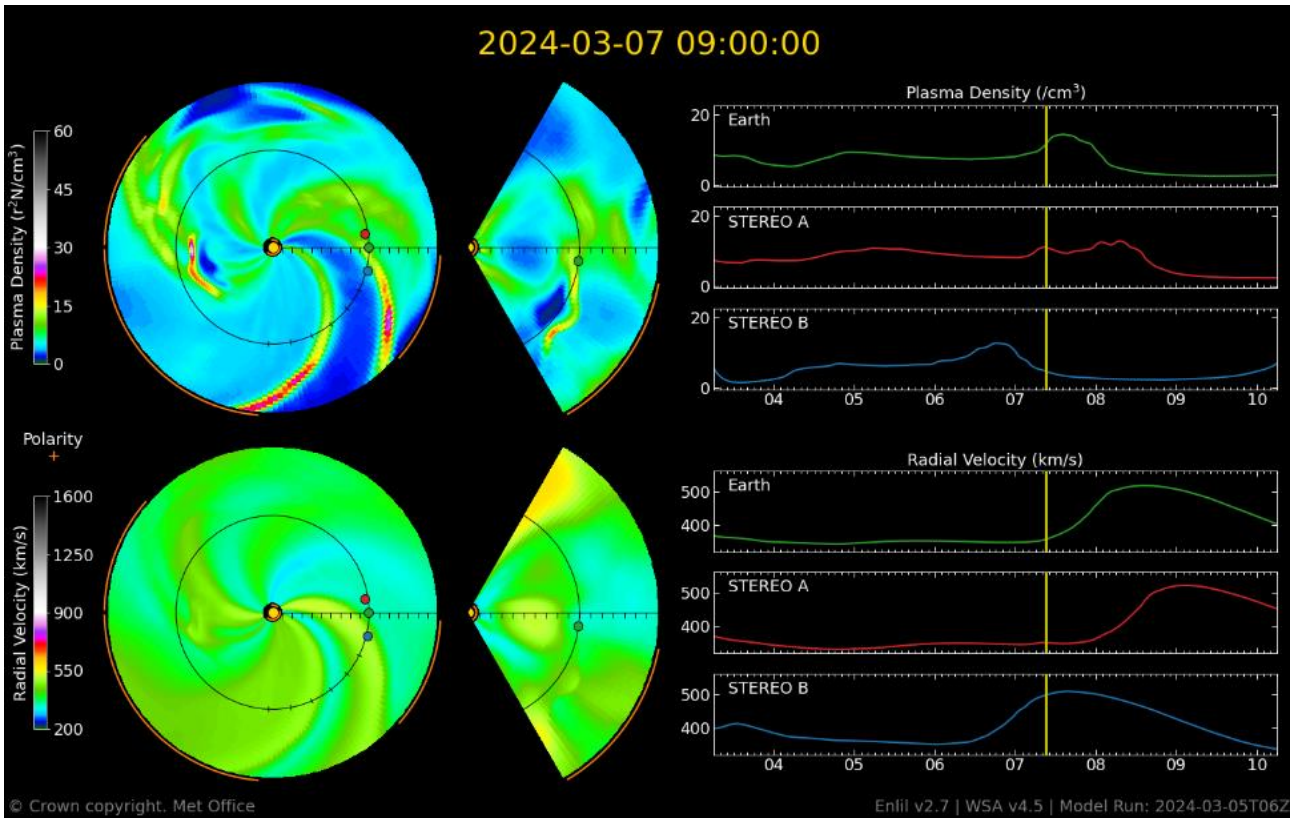
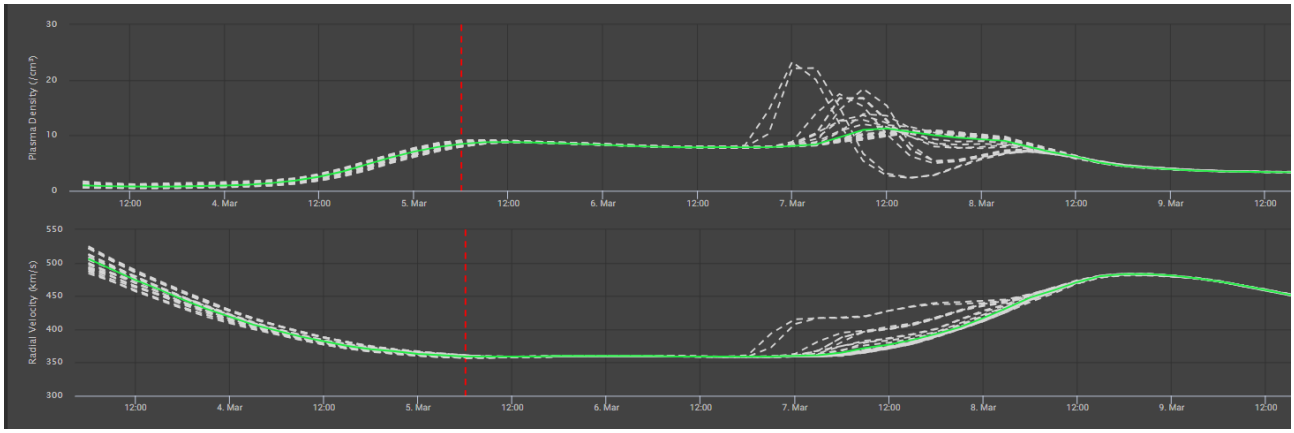
Figure 2: MOSWOC Enlil model and Enlil ensemble, showing deterministic solution for CME arrival and range of possible variation in arrival of any glancing CME.





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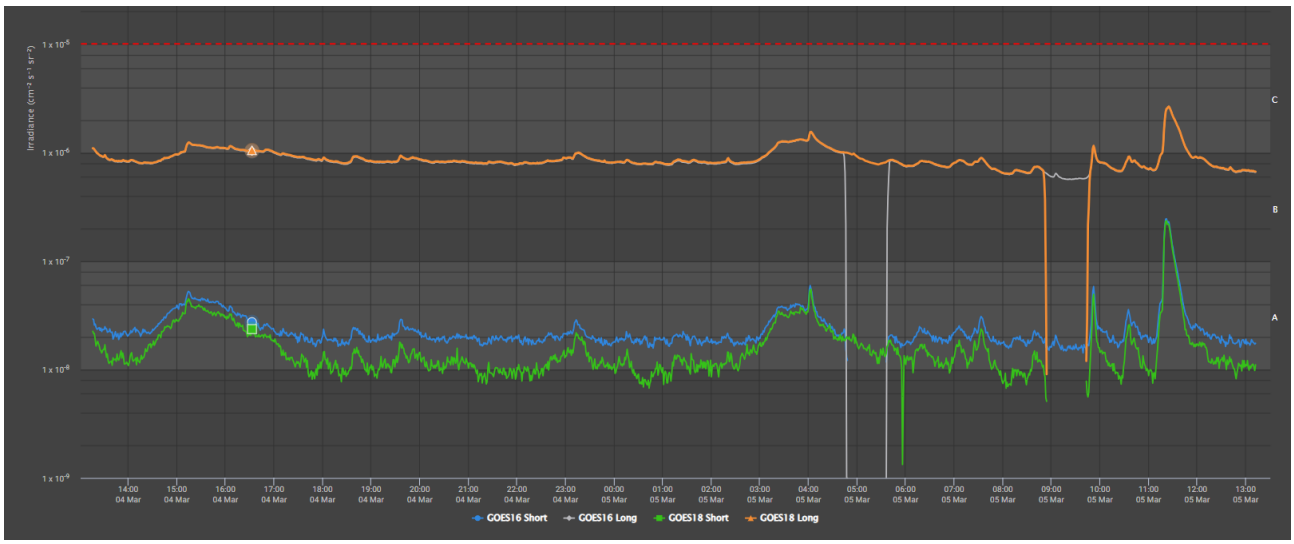
Radio Blackouts - X-Ray Flares:
There are 11 sunspot regions on the visible disc, with the majority of these either weak or fading. The most notable region on the disc is AR3595, and although still large, this region has decreased in complexity as it approaches the western limb. AR3602 is only other region of note, with some emergence of a positive region to the north of the main spot in an atypical north-south alignment.

Low activity is expected, with a chance of isolated Moderate activity. There is a risk of a complex region rotating onto the eastern limb from 06 March, with this balancing the loss of AR3595 later in the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is expected to remain so through the period. There is just a very slight chance of rising above the S1/Minor Radiation Storm threshold should any significant flares mainly from AR3595 as it approaches the western limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to remain at mainly background levels through the forecast period, with no significant inputs. The result of an enhancements from either the CME or coronal hole high speed stream are more likely to be realised following the end of this forecast period.

Consequently, the electron fluence is expected to remain well below the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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